Light scattering studies of composite interstellar dust analogues using computer simulation and laboratory setup

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Dust particles found in the interstellar medium have been reported to be composed of amorphous silicate, graphite, amorphous carbon, carbonates, metal oxide grains, amorphous ice particles and even nanodiamonds. Study of the light scattering properties of such dust particles by using both computer simulations and laboratory experiments (with analogue samples) provide significant information for interpreting scattered light signals from unknown interstellar dust particles.

Here we report the study done on light scattering by interstellar dust analogue mixtures of graphite and fayalite at three incident wavelengths, that is, 543.5, 594.5, and 632.8 nm, using two computational models for particle sizes ranging from 0.3 μm to 5.0 μm. The scattering and extinction efficiencies, single scattering albedo, asymmetry parameter, phase function and degree of linear polarization are calculated using the Discrete Dipole Approximation. A comparative analysis of the theoretical and experimental results of phase function and polarization shows that the percentage composition of a mixture model is very important while simulating interstellar dust particles. The developed computational models are successful in representing a two species mixture of interstellar dust analogues dispersed in both shapes and sizes. This technique can be applied to interpret observed astrophysical data, to study atmospheric aerosols and in remote sensing.

References

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